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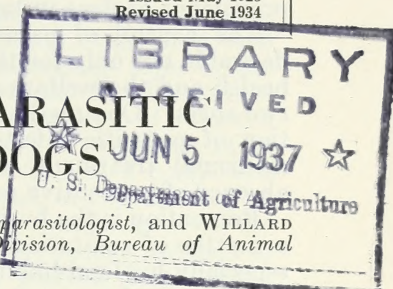
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PARASITES AND PARASITIC DISEASES OF DOGS

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IMPORTANCE OF PARASITE CONTROL

The parasitic diseases of dogs and cats rank in importance with the bacterial diseases affecting these animals. No such provisions exist for collecting statistics on diseases of animals as there are for collecting statistics on diseases of man, so it is not possible to make such close approximations as to prevalence of disease in veterinary medicine as in human medicine. But conceding first place to distemper, that almost universal scourge of dogs with its mortality commonly estimated by veterinarians at about 50 percent, the various forms of mange are probably entitled to a second position, with a group of worm infestations following in importance. Worm infestations, especially roundworm and hookworm infestations, are especially prevalent and deadly in puppyhood and most so in tropical and subtropical countries, although by no means unimportant in temperate zones. There are a large number of worm parasites and of external parasites, such as insects and ticks, reported from dogs and cats, but only a few of the more important ones are considered here.

The importance of these parasites, especially those of dogs, is heightened by the fact that a number of them are transmissible in some form to man and to livestock. A number which occur as adults in the digestive tract of the dog also occur in the same form and in the same place in man. In addition dogs have a number of adult parasites which occur as larval or immature parasites in man

1 This circular, as revised, includes information on parasites affecting cats.

and livestock, including the deadly hydatid with a mortality of about 50 percent for human patients in cases not operated on, various other tapeworms which have their larvae (bladderworms) in cattle, sheep, goats, swine, reindeer, etc., and tongueworm, with both adult and larval stages occurring in man and livestock. Finally, dogs carry such parasites as fleas, which attack both man and dogs, and transmit sarcoptic mange to other dogs and to man. In many cases the annoying prevalence of fleas in houses is directly due to flea-infested dogs.

The control of parasites in the dog is therefore necessary and desirable not only for the sake of the dog but for the sake of human health and the welfare of the livestock industry. This control is of two sorts. One method of control is that of prophylaxis or prevention of parasitic infestation and disease, and the other is that of medicinal treatment where parasitism is actually present in the absence of preventive measures or in spite of them.

Prevention is the business and duty of the dog owner. It is largely a matter of sanitation and careful supervision of the dog's habits, especially his food habits. Dogs usually become infested with parasites in one of two ways:

(1) By being in contact with infested premises or infested animals. Dogs transmit their fleas and lice to one another and transmit their fleas to man and also infect the premises with flea eggs and larvae, thus giving rise to adult fleas which attack the first human or canine victim that comes in reach. Worm eggs pass in the feces (excrement) of the dog and develop to the stage where the eggs or the larval worms hatching from them will infect dogs or persons, infection sometimes taking place as a result of swallowing the eggs or larval worms in contaminated food or water, and sometimes as a result of the larval worms burrowing through the skin when it is in contact with contaminated soil.

(2) Dogs become infested with parasites by eating raw or insufficiently cooked meat, neglected carcasses, discarded viscera, or raw fish containing the larvae of worms. Such larval worms include the bladderworms occurring in the viscera of cattle, sheep, goats, swine, and rabbits. It is the duty of the owner to see that premises are kept clean, that the excrement is removed frequently and thoroughly, that dogs eat only suitable and safe food, and that dogs are bathed and kept clean and free from vermin of all sorts. This involves supervision of the dog's habits to the extent of not allowing the animal to run at large under conditions that permit it to eat whatever carcasses it may find or whatever animals it may kill. The dog that eats offal at the country slaughterhouse or kills and eats rabbits is practically certain to become infested with tapeworms. Slaughterhouse offal is probably the most important source of infestation of dogs with hydatid tapeworm, a menace alike to the owner of the dog, his family, and his livestock. The neglected dog running at large collects fleas and lice and contracts mange to an extent not possible to the dog that is properly cared for and supervised.

Medicinal treatment is the business of the veterinarian, not of the dog or cat owner. It involves an accurate diagnosis, a matter that calls for special training, medical skill, and adequate experience, things which the dog or cat owner is not likely to possess. Errors in diagnosis mean misdirected efforts, with the possibility of injury to the sick animal, loss of time and money, and the possibility that this lost

time will allow the real condition to go unrecognized until it is too late to save the animal. Treatment also involves the use of highly potent drugs, carefully selected with due regard to the end to be accomplished, and administered in such doses and in such a way as to cure disease without injuring the patient. The possible contraindications for treatment, conditions which make it evident that certain drugs or doses are dangerous, must be ascertained and kept in mind. The anthelmintics (drugs used to remove worms) are always poisonous, being intended to poison the worms, and must be given in such doses as will accomplish that object without materially injuring the patient. Insecticides injudiciously applied to the skin to kill parasites may injure the skin or kill the patient. In this discussion of parasites a number of treatments are described, since it may be necessary for an owner to treat his dogs or cats, when the services of a competent veterinarian are not available. It is understood, of course, that an owner gives such treatment at his own risk and that he assumes the responsibility for his diagnosis, selection of drugs, dosage, method of administration and technic, and the risk of possible bad results. Each animal presents his own special individual case, and no general directions can cover all of the possibilities. Passing judgment on the individual case is precisely where the skilled veterinarian becomes indispensable, and whenever possible he should be employed.

EXTERNAL PARASITES AND PARASITIC SKIN DISEASES

MANGE

The dog suffers from mange of three sorts—sarcoptic mange, ear mange, and demodectic mange, whereas cats usually are affected only by the sarcoptic type. Sarcoptic mange in dogs occurs over the body and is characterized by the formation of crusts or scabs in advanced stages of the disease; this form of mange in cats is usually restricted to the head and neck. Ear mange, as the name implies, occurs in the ears. Demodectic mange, also called red mange or follicular mange, occurs over the body and is characterized by a falling out of the hair and frequently a reddening of the skin in the early stages, the condition commonly progressing to the formation of pustules. In this disease and in sarcoptic mange there is a characteristic unpleasant "mousy" odor.

CANINE SARCOPTIC MANGE

Cause.—Canine sarcoptic mange is due to the canine sarcoptic mange mite, *Sarcoptes scabiei canis*, a form related to the spiders. This mite is very small, the largest specimen being less than one-fiftieth inch long. The general appearance under the microscope is that shown in figure 1. The sarcoptic mites, this form and its near relatives, have very short hind legs, not projecting beyond the margin of the body. When a dog is suspected of having mange, a portion of the diseased skin should be scraped with a dull knife and the scraping examined for mites. The scraping must be deep enough to draw blood, as these mites burrow deep into the skin, and it may be necessary to make scrapings from several areas. The scrapings should be softened by soaking in a solution of caustic soda or caustic potash for half an hour or more, the strong solutions acting more rapidly than weak ones, and then placed on a glass slide under a cover glass and

examined with the low powers of the microscope. Whenever possible this examination should be made by a competent veterinarian or zoologist, as these mites are frequently difficult to detect. The finding of the mites is sufficient to confirm the diagnosis of mange, but failure to find mites, while it establishes a presumption that the disease is not mange, does not prove the case, as the mites may be overlooked or not reached by the scraping.

Symptoms.—Sarcoptic mange affects dogs of all ages and all breeds. It usually begins about the head and may spread over the entire body in the course of a month. It appears first in the form of red points which soon become papules or vesicles, most easily seen where the skin is thin and without pigment, as on the abdomen. As the mite burrows into the skin it causes irritation and there is an exudate of

serum. As this constant flow of serum dries it forms the characteristic scab. Simultaneously this irritation gives rise to itching, which becomes intense in the presence of heat or after exercise, and the animal scratches and rubs the affected portions of the body. In doing so it rubs off the scabs and opens up sores. Bacterial infection of these areas may add to the inflammation and injury resulting from the presence of the mite and the scratching. The hair also may become matted and fall out. There is evidently more or less toxic absorption from the mites or from the diseased skin, as shown by a blood reaction in the form of an eosinophilia, a condition frequently associated with parasitism, and the presence of the toxins and the loss of nervous energy due to constant itching and irritation cause the animal to become

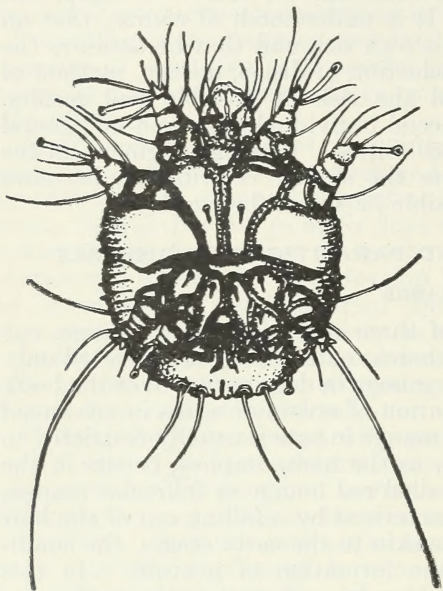


FIGURE 1.—The canine sarcoptic mange mite, *Sarcoptes scabiei canis*. Ventral view. Female. Enlarged. From Fiebiger, after Fuerstenberg. (Micron measurements: Male, 190 to 250 long by 140 to 180 wide; female, 290 to 450 long by 230 to 350 wide.)

weak and thin. The skin may show large sores, and the mangy or "mousy" odor becomes very pronounced. A general impairment of digestion and other body activities follows and if the disease goes unchecked the animal dies, usually in 2 or 3 months under conditions favorable to the disease. The term "mangy dog" as an expression of reproach shows the general appreciation of the extremely pitiable condition and apparent worthlessness of such an animal.

Treatment.—A great aid in the treatment of mange is the use of such measures as will build up the general health and resistance of the animal. The dog should receive plenty of good nourishing food, including a supply of meat suited to the animal's condition and the amount of exercise it can take. Exercise and fresh air are important. Delafond and Bourguignon have recorded the cure of sarcoptic mange in the dog by suitable diet, exercise, fresh air, and hygienic measures,

even in an advanced stage of the disease. It is well known that susceptibility to mange and scabies in various animals depends in part on the general condition of the animal and on weather conditions. Mange in horses and scabies in cattle are much more prevalent in winter than in summer and more so among animals poorly fed and cared for than among animals well fed and cared for. On the other hand, it is reported that dogs in Greenland suffer from mange in the summer, the disease becoming latent or cured in winter.

In addition to hygienic measures, various treatments may be used to destroy the mange mites and cure the disease. Among the many treatments which have been used and recommended, a few are noted here.

The hair over the diseased portions of the body should be clipped, and it is usually advisable to clip it over the entire body. The hair may cover up evidence of areas in early stages of mange, from which areas the disease may spread after apparent cure of evidently diseased areas, and the removal of the hair simplifies treatment and makes it possible to use smaller amounts of medicinal substances effectively. The crusts present may be rubbed with green soap to soften them and an hour or two later the soap and crusts removed with a brush and warm water. The next day the application of substances intended to destroy the mites is begun by treating one fourth of the body, a different quarter being treated each successive day, so that the entire body is treated in the course of 4 days. The applications to each quarter are rubbed in thoroughly, left on for about 4 days, and then removed with warm water and soap. After each course of treatment the applications are omitted for 3 or 4 days and then repeated until the skin is healed and the itching and irritation have disappeared. One application that may be used consists of 1 part each of oil of tar and green soap in 1 to 5 parts of alcohol. Another is 1 part each by volume of oil of tar and crude petroleum oil, and 6 parts of liquid petrolatum. Another is cresol liniment, consisting of 2 parts aqua cresolis and 1 part each of soft soap and alcohol. Another is sublimed sulphur 2 parts, oil of tar 1 part, potassium carbonate 1 part, and lard 8 parts. Another is an ointment, consisting of sublimed sulphur 150 grams, potassium carbonate 8 grams, and lard 60 grams. Another is flowers of sulphur 1 part, tincture of iodine 1 part, oil of tar 8 parts, and olive oil 8 parts. Ordinary sulphur ointment, 1 part sulphur to 8 parts lard, may be used; to this may be added 1 dram of balsam of Peru. The ordinary lime-sulphur dips may be used. The animals should be prevented from licking the applications, by the use of a muzzle, broad collar, or some other means.

During the period of treatment the bowels must be kept open by the use of castor oil or Glauber's salt, daily, if necessary. The animals must be protected from cold. All diseased animals should be isolated for their own benefit and for the protection of those not diseased. It should also be kept in mind that sarcoptic mange of the dog is transmissible to man and that due precautions should accordingly be taken in handling mangy animals. The disease is also transmissible to the horse. Mange is a debilitating disease, leaving the patient more susceptible to various other diseases, and mangy animals are poor subjects for treatments to remove worms, being weakened to the point where they are much more liable to

succumb to the toxic effects of such anthelmintics as chenopodium than are animals without such complications as mange.

In connection with treatment, one must remember that the premises used by mangy dogs are infected and that disinfection is therefore necessary. So far as possible, litter of all sorts should be burned. Kennels and other constructions should be thoroughly cleaned and then disinfected with hot, strong coal-tar disinfectants.

FELINE SARCOPTIC OR NOTOEDRIC MANGE

Cause.—Sarcoptic or notoedric mange in cats is due to the presence of a mite, *Notoedres cati*, which is smaller than the sarcoptic mite of dogs; it may be distinguished on microscopic examination from the sarcoptic mite of the dog by reference to figure 2. This form of mange is transmissible to dogs, and this possibility should be kept in mind where dogs and cats are associated. This type of mange is also communicable to man.

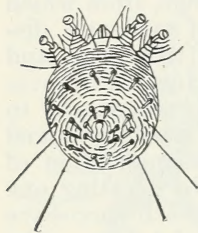


FIGURE 2.—The feline sarcoptic mange mite, *Notoedres cati*. Female. Dorsal view. Enlarged. From Gedoelst, 1922, after Mègnin. (Micron measurements: Male, 145 to 150 long by 120 to 125 wide; female, 245 to 280 long by 165 to 175 wide.)

Symptoms.—The mites usually attack the skin of the neck, ears, and face, and in severe cases the entire head and neck may be affected. The initial lesion is in the form of a small vesicle which is about the size of a pinhead. The vesicles later become confluent and crusts are formed. The hair becomes matted and may fall out. Itching varies in intensity in individual animals. As the disease progresses the animal presents a dejected appearance, and death may occur in from 4 to 6 months. In dogs this type of mange is confined usually to the head.

Treatment.—Coal-tar preparations and other preparations containing phenol should not be used in the treatment of mange in cats, as cats are particularly susceptible to poisoning with such compounds. An ointment composed of 1 part sulphur to 8 parts lard or equal parts of olive oil or cottonseed oil has been found effective in many cases. Helmerich's ointment, composed of sublimed sulphur 150 grams, potassium carbonate 8 grams, and lard 60 grams, has been recommended. A mixture of balsam of Peru 1 dram, and sulphur ointment 1 ounce, may be used but care should be taken not to apply this preparation over too extensive an area of the skin, as poisoning may result. As in the case of dogs, the hair should be slipped over the affected areas and the scales softened with green soap before the application of mange remedies.

EAR MANGE

Cause.—Ear mange is due to a mite, *Otodectes cynotis*, which is slightly larger than the canine sarcoptic mite. Owing to their size and the fact that they do not burrow, it is often possible to see these mites (fig. 3) with the naked eye, either in the ear or in detritus removed from the ear, the mites appearing as small white objects moving slowly about.

Symptoms.—These mites puncture the tissues forming the external canal of the ear and feed on the serum, causing an irritation which, among other things, interferes with the normal production and disposal of earwax. As a result the ear canal may become filled with detritus, consisting of more or less modified earwax and inflammatory products in the form of scales or powder. The mites appear to begin operations in the region of the eardrum, but as they multiply the canal becomes more or less filled with the mites, frass, wax, and scales. The mites alone cause a mild irritation and a pronounced itching, but the itching causes the dog to scratch and rub its ears and shake its head, and these activities on the part of the dog give rise to scratches, sores, and bleeding. Affected dogs frequently whine or howl, and in severe cases may show epileptiform spasms, travel in a circle, or show other evidences of nervous disturbances. More or less deafness may follow from the plugging of the ears and from injuries to them. Bacterial complications may follow, and inflammation of the middle and the inner ear and even of the brain is said to occur in rare instances. The

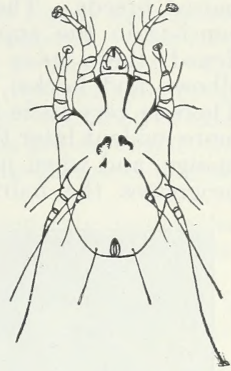


FIGURE 3.—The ear mite, *Otodectes cynotis*. Female. Ventral view. Enlarged. From Banks, 1915. (Micron measurements: Male, 350 to 380 long by 250 to 280 wide; female 340 to 530 long by 210 to 350 wide.)



FIGURE 4.—The demodectic mange mite, *Demodex canis*. Female. Ventral view. Enlarged. From Hirst, 1919. (Micron measurements: Male, 220 to 250 long by 45 wide; female, 150 to 300 long by 45 to 55 wide.)

condition may be diagnosed by carefully removing some of the material from the ears and finding mites in it by examination with the naked eye, a hand lens, or a microscope, or in earlier stages by recovering these mites by carefully swabbing the region of the eardrum with a pledget of cotton moistened with a bland oil, or by examining the ears with a speculum or otoscope in a good light with suitable illumination.

Treatment.—Treatment for ear mange is not especially difficult. If the ear is full of detritus, this should be removed with forceps or a swab, taking care not to injure the eardrum. The ear canal can then be liberally swabbed with a cotton pledget soaked in one of the following preparations: 1 percent carbolic acid or creosote in glycerin; 5 percent carbolic acid in olive oil or castor oil; 1 part carbon tetrachloride and 3 parts castor oil; or 1 part chloroform in 9 parts olive oil or castor oil. Repeat treatment daily until the animal is cured.

DEMODECTIC MANGE

Cause.—The mites, *Demodex canis* (synonym, *D. folliculorum* var. *canis*), responsible for demodectic mange, differ materially in form from those already described, being elongated, vermiform objects (fig. 4). They are very small and can be detected only by the aid of the microscope. The diagnosis of demodectic mange (follicular mange or red mange) may be made by finding the mites in scrapings. The scrapings

must be deep enough to draw blood, as the mites live down in the hair follicles. The scrapings may be macerated in caustic and

examined, the procedure being as given for the diagnosis of sarcoptic mange.

Symptoms.—Demodectic mange may occur in dogs of all ages and breeds but appears to be more common in young animals and short-haired breeds. The first evidence of demodectic mange, as a rule, consists in the appearance of hairless spots, often somewhat reddened, these spots commonly occurring about the eyes or at the elbows and hocks, though they may appear first in other places. There is very little itching at this time, and though itching may be more evident later there is usually less of it than in cases of sarcoptic mange, and when present it is usually intermittent. As the disease progresses the hairless areas become more extensive and redder,



FIGURE 5.—Dog with demodectic mange, depilatory form.

though later the skin may be lead gray in color. This is the so-called depilatory stage of the disease (fig. 5). At this stage the mites are increasing in the hair follicles, and the visible skin changes are evidences of inflammatory conditions about the follicles and their sebaceous glands. As many as 200 mites may occur in a single hair follicle.

Usually the depilatory form of demodectic mange, due to the uncomplicated cases of mite infestation as described above, becomes complicated in time through the invasion of the weakened and diseased skin by pus-forming bacteria, and sometimes these complications appear to be present from the onset of the disease. This condition is the pustular stage of the disease (fig. 6) and in this stage the previously hairless and reddened areas now show numerous pustules. In and under the skin there are numerous abscesses or pus

pockets, local destruction of the true skin or dermis takes place, and, according to some investigators, some mites now wander out of the hair follicles and may even enter the subcutaneous tissues. The numerous pustules run together and the skin becomes thickened and so seriously weakened from disease that it is highly susceptible to injury from rubbing or contact with various objects. The odor is very unpleasant. There is little or no itching in this stage. The absorption of toxic products from bacteria and diseased skin tissue serves to poison the entire system; bacteria may enter the blood stream, causing generalized infection; the bodily functions are deranged; the animal becomes emaciated and weak, and unless the disease is checked the dog dies in a very pitiable condition.

The disease usually runs a very slow course, commonly for months, and sometimes up to 2 years or longer. In rare cases there is spontaneous cure.

Treatment.—The subject of treatment for demodectic mange is still a controversial matter. Some competent veterinarians report a large measure of success in treating this disease, but others find treatment generally unsatisfactory and will not undertake it. In advanced cases of pustular mange destruction of the animals is commonly recommended. In general, the treatment of such cases is such a long, costly, and tedious affair, and



FIGURE 6.—Dog with demodectic mange, pustular form.

so often ends in failure to obtain a cure, that the owners of the dogs are dissatisfied. This is especially true because dogs usually are not brought in for treatment until the disease reaches the pustular stage. After a few experiences of this sort the veterinarian prefers to avoid trouble with his clients and the presence of such unpleasant and unprofitable patients. When the treatment is left to the owner it frequently happens that he wearies of carrying out the prolonged treatment, forgets it from time to time or finds it inconvenient to attend to it, or neglects details and thoroughness. Even if he carries it out conscientiously, failure to cure is not an uncommon result, as much depends, apparently, on the condition and resistance of the individual animal. The senior author cured one case of extensive simple depilatory mange in a dog by the daily application of a mixture of olive oil 100 cubic centimeters, chloroform 30 cubic centimeters, and thymol 5 grams, but it required 100 treatments. In spite of sentimental considerations, few dog owners would care to carry out a treatment of this magnitude, especially in view of the fact that failure would

follow in some cases. In general, treatment should be begun early. The disease is more curable in the depilatory and localized cases than in the pustular and generalized cases.

The animal should be clipped before treatment is begun. Of the treatments which have been recommended, one which has the merit of simplicity and safety and is recommended as very effective, consists in the daily application of castor oil to and around the diseased areas. Whatever is used should be thoroughly rubbed into the skin, not neglecting its application between the toes if needed. Liquid oil of tar has given good results in some cases and failed in others. Another treatment consists in the application to one fourth of the body daily, as directed for sarcoptic mange, of an ointment consisting of liquid phenol 1 part, camphor 2 parts, and white petrolatum 6 parts, the dog being bathed on the fifth day in a 2-percent solution of sulphurated potassa, and the treatment begun again the following day and continued as long as necessary. Another treatment which is variously recommended as a cure for demodectic mange or for the inflammation of the skin accompanying it, consists in the daily application of Lassar's paste, which is salicylic acid 2 parts, starch 24 parts, zinc oxide 24 parts, and white petrolatum 50 parts. Another treatment consists in the use of a 1- to 5-percent formaldehyde solution; the dog is dipped in this or liberally sponged with it, the dog's eyes being protected, and the animal then coated with sulphur ointment or petrolatum. This treatment is repeated every 3 or 4 days until 4 or 5 treatments have been given, the ointment being removed before each formaldehyde bath. One objection to the use of formaldehyde is that it is painful, having a sting comparable to that of the formic acid of an ant bite. A treatment which has been recommended widely consists in the use, once a week, of the following preparation: Kerosene 8 ounces, raw linseed oil 8 ounces, carbolic acid 1 ounce, oil of tar 1 ounce, and sulphur one-fourth pound; this is applied with mild rubbing. Good results have been reported in some cases of demodectic mange following the daily application of a 1-percent solution of rotenone. The solution is made up by dissolving 1 gram of rotenone in 10 cubic centimeters of acetone and then adding 50 cubic centimeters of alcohol and 40 cubic centimeters of distilled water. The solution should be shaken before use.

In connection with any medicinal treatment, the supplementary measures noted under the subject of sarcoptic mange should be used. In addition, the treatment of the pustular type of demodectic mange should be begun by opening the pustules with a sharp knife and squeezing out the pus. Under some conditions it has been recommended that the skin be scarified and treated with tincture of iodine, but this procedure should be left to the judgment of the veterinarian and carried out by him. Dogs are fairly susceptible to iodine poisoning. The pustular stage of mange is said to be greatly benefited in some cases by the injection of autogenous bacterins or stock polyvalent bacterins of streptococcic and staphylococcic bacteria of strains isolated from cases of demodectic mange, but the use of these bacterins should be left to the veterinarian. Arsenic, in the form of Fowler's solution, and sulphur are sometimes given internally for their effects on the system. Violet rays and even X-rays have been used in demodectic mange, and good results reported in some cases.

CHIGGER INFESTATION

Cause.—The common American chigger, *Trombicula irritans* (also called harvest mite), is a small, red or orange-yellow mite (fig. 7) which as a six-legged larva (the adult mite has eight legs) attacks man and the domesticated animals. It occurs from New York to central Mexico and from the Atlantic Ocean to the Rocky Mountains. A very closely related species occurs in the northern and western part of this country. Chiggers have been thought to burrow into the skin and die there, but recent investigations indicate that they do not burrow, but merely attach by the mouth parts, and if left alone become engorged and fall off.

Symptoms.—Chiggers cause intense itching and this results in scratching and rubbing which in turn often result in the formation of sores with subsequent bacterial infection. Hunting dogs are especially subject to attack, owing to exposure as they range over chigger-infested territory. The chiggers attach most often about the head, feet, and belly, causing scattering eruptions which may contain pus. Chiggers usually attach singly, but a dozen or so sometimes attach at one point. Under favorable conditions they may be seen with a hand lens, but as a rule chigger infestation in dogs or cats would be suspected from signs of itching coupled with a history of chigger attacks on man at the same time and in the same vicinity.

Treatment.—Sulphur ointment will destroy chiggers at the point of attachment and in some cases appears to have a favorable effect on infected sores due to scratching the places attacked by chiggers. Alcohol in free and repeated applications is also good. Solutions of coal-tar creosote dips, in the strengths recommended on the labels for dipping or washing dogs, may be used. Ammonia, sodium bicarbonate, or dilute tincture of iodine serves to alleviate the itching.

Flowers of sulphur has been found of value in preventing attacks on man by chiggers, and it is probable that it would be of value in protecting dogs or cats if dusted into the hair. The coal-tar creosote dips would doubtless be of value for the same purpose. Such dips should not be used for cats. Oil of tar or fish oil, applied diluted with alcohol, would probably be repellent but objectionably messy. The cultivation of ground and the clearing away of underbrush and rank vegetation aid in keeping down chiggers.



FIGURE 7.—The common American chigger, *Trombicula irritans*. Enlarged. From Ewing and Hartzell, 1918, after Oudemans. (Micron measurements: Newly hatched larva, 330 long by 160 wide. Engorged larva, 1.5 mm long by 320 microns wide. Measurements by H. E. Ewing.)

TICK INFESTATION

Cause.—Various species of ticks will attack dogs and about 14 species have been reported from the dog in North America. The more important of these in the United States are the American dog tick or wood tick, *Dermacentor variabilis*, and the brown dog tick, *Rhipicephalus sanguineus*; these ticks rarely occur on cats.

The American dog tick (fig. 8) usually occurs as an adult tick on dogs, the earlier stages (those of seed tick and nymph) occurring on various small mammals. It attaches to various parts of the body,



FIGURE 8.—The American dog tick or wood tick, *Dermacentor variabilis*. Left, engorged female; right, male. Dorsal views. Enlarged. From Banks, 1908.

but displays a preference for the ears. When fully engorged with blood the female tick is almost half an inch long and of a bluish color, with a reddish-brown shield with white markings on the back near the head. This species occurs in the eastern half of the United States, in parts of the west coast, and occasionally elsewhere in this country.

The brown dog tick (fig. 9) occurs on dogs as seed tick, nymph, and adult. It frequently attaches inside a dog's ears, sometimes deep in the ear canal. The young ticks are likely to be abundant in the long hair on the neck, but any stage may occur on almost any part of the body, including the spaces between the toes. In this country this tick occurs in the South, being reported from Texas, Louisiana, Mississippi, and Florida, but it may be found farther north, being reported from Ohio, Pennsylvania, and New York. Its occurrence in these Northern States is due, no doubt, to the fact that dog owners have transported ticky dogs, mostly hunting dogs, from the South to the Northern States. It appears to have taken up the habit of living indoors over winter as an adaptation to cold winters, and according to F. C. Bishopp, of the Bureau of Entomology, and reports from various persons, causes serious trouble by establishing itself in kennels and about houses.

Symptoms.—Ticks cause local irritation at points of attachment, and dogs commonly bite or scratch these places. In heavy infestations the injury may be serious. In addition to the local injury there is a loss of nervous energy from irritation. The tick buries



FIGURE 9.—The brown dog tick, *Rhipicephalus sanguineus*: A, Male; B, unengorged female. Enlarged. From McIntosh, 1931.

its mouth parts in the dog's skin and sucks blood, and this loss of blood, a relatively unimportant matter in a light infestation with ticks, becomes a serious matter in a heavy infestation. Certain ticks are capable of causing a rapidly fatal paralysis, and cases of the sort have been reported in dogs. Other ticks carry diseases from one animal to another, as in the case of the cattle-fever tick, which carries tick fever of cattle in the Southern States. The brown dog tick of this country carries a disease—canine piroplasmosis—which is very similar to tick fever. The American dog tick has been shown to transmit the eastern form of Rocky Mountain spotted fever of man.

Treatment.—The simplest control measure and one which is usually applicable consists in the removal of the ticks by means of the fingers or with forceps. Occasionally the mouth parts of the tick will be left in the skin and may form festering sores, but this does not occur very often. The control of ticks by hand picking is a time-consuming process, however. For this reason, considerable search has been made for an insecticide which would be effective for the destruction of the parasites and yet safe for the host. It has been reported that an extract of pyrethrum flowers containing a uniform and definite percentage of active ingredients is effective for the destruction of the brown dog tick. Such preparations are marketed under proprietary names. A stock solution is made by mixing 1 part of the pyrethrum extract with 3 parts of a solution of $1\frac{1}{2}$ pounds of green soap dissolved in one-half gallon of water. To this combined solution is added water sufficient to make a dilution of 1 part pyrethrum extract in 19 parts of the soap-and-water solution. The solution is applied by means of a sponge until the coat of the animal is thoroughly saturated with the liquid. This preparation is said to kill larval ticks almost immediately. It is reported that engorged females live for a day or more after treatment, but finally succumb.

A 5- to 7-percent solution of pine-oil disinfectant has been recommended for the destruction of the brown dog tick. The use twice weekly of a powder containing 3 percent of rotenone is reported to be effective for the destruction of these ticks. The use of drugs or chemicals for the destruction of ticks on cats is not recommended. Where animals are exposed to reinfestation, the use of any treatment can only be palliative. Effort should be made to rid premises of ticks in various stages of development by spraying kennels and runs with a hot coal-tar creosote solution or with a pyrethrum emulsion. As the brown dog tick can live for months under favorable conditions without feeding, this is a control measure of great importance.

Whenever possible, dogs and cats should be kept out of tick-infested woods and out of contact with tick-infested stray dogs.

LOUSE INFESTATION

Cause.—The dog is commonly infested with two species of lice. One of these is a sucking louse, the sort commonly present on mammals, and the other a biting louse related to the bird lice.

The sucking louse, *Linognathus piliferus* (synonym, *Haematopinus piliferus*), is pale yellow, less than one twelfth of an inch long, and has a long, slender head (fig. 10), very different from the wide, blunt head of the biting louse. It may appear blue after feeding on blood.

The biting louse, *Trichodectes latus* (synonym, *T. canis*), is clear yellow in color, with darker markings, smaller than the sucking louse, and has a short, wide, blunt head (fig. 11).

Cats are susceptible to attacks by the louse, *Trichodectes subrostratus*, which is about the size of *T. latus* of the dog, but has a more pointed head. This is the only louse infesting cats; it is not common.

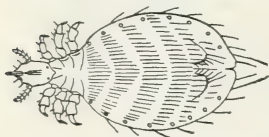


FIGURE 10.—The sucking louse of dogs, *Linognathus piliferus*. Female. Ventral view. Enlarged. From Neveu-Lemaire, 1912. (Measurements: Male, 1.5 millimeters long; female, 2 millimeters long.)

Symptoms.—The sucking lice feed on serum and blood, and the biting lice feed on the scales, scurf, and superficial portions of the skin. In either case they cause irritation, which may be excessive in heavy infestations. The itching due to their bites causes the infested animal to scratch and rub, sometimes causing sores in this manner, and constitutes a drain on the nervous energy. Long-haired dogs appear to be more susceptible to louse infestation than short-haired dogs, and pups

and very old dogs are more susceptible to infestation and suffer more from it than dogs of about mature age. The biting louse shares with the flea the role of intermediate host of the common double-pored tapeworm (p. 28), the louse becoming infested with the intermediate stage of the tapeworm as a result of swallowing tapeworm eggs as it feeds on the contaminated skin of the dog, and the dog becoming infested with the tapeworm by swallowing such infested lice. The tapeworm sometimes occurs in man, especially children, infection occurring in the same manner as in the dog.

Treatment.—Lice may be destroyed by dipping the dog two or, preferably, three times at intervals of from 8 to 10 days in one of the coal-tar creosote dips, diluted as stated on the label for use on dogs. Repetition at a suitable interval is necessary, as these dips do not destroy the eggs, and the lice hatching from them must be destroyed before they in turn can lay more eggs. Clipping is an aid in treatment, as it removes many of the eggs which are attached to the hairs and permits better contact and penetration by the insecticide. The hair clippings should be burned to destroy the lice and their eggs (nits). Oils, such as castor oil, cottonseed oil, or olive oil, may be used to destroy lice, the oil being left on for several hours and then washed off with warm water and soap. After being oiled, a dog should be kept in a clean box to keep him from rolling in dirt.

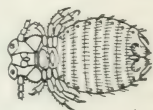


FIGURE 11.—The biting louse of dogs, *Trichodectes latus*. Female. Ventral view. Enlarged. From Neveu-Lemaire, 1912. (Measurements: Male, 1.4 millimeters long; female, 1.5 millimeters long.)

A thick lather of whale-oil or fish-oil soap, or an emulsion of 8 parts of the soap to 1 part kerosene may be used, but kerosene must be used with caution, the emulsion well made, and the animal not allowed in the bright sunlight for several hours after treatment. When weather conditions do not permit dipping or clipping, or when clipping is undesirable, palliative measures, not very effective in eradicating lice, may be used. Such measures consist in dusting the hair thoroughly with pyrethrum powder (buhach or ordinary Persian,

Dalmatian, Caucasian, or Oriental insect powder), allowing it to remain on for half an hour or so, and then combing or brushing it out, with the dead and stupefied lice, on to a newspaper, the paper, lice, and powder then being burned. This treatment must be repeated a number of times in order to keep down the lice. Other powders, containing such insecticides as naphthalene, sulphur, and tobacco, may be used in the same way.

Experiments indicate that derris powder, when fresh, is effective for the destruction of lice on dogs and cats. It is used in the proportion of 1 part of derris to 2 parts of flour or corn starch, the mixture being thoroughly dusted into the hair. Pyrethrum powder also may be used for the destruction of lice on cats. As previously stated, coal-tar creosote preparations or other preparations containing phenol should not be used on cats.

When only biting lice are present they may be destroyed by dusting sodium fluoride into the hair and leaving it on, the animal not being washed for the next 10 days. One application will usually destroy all the lice. The animal should be prevented from licking itself, as 1 gram (about one-fourth teaspoon) of sodium fluoride will kill a dog of average size. This chemical is not of value against sucking lice.

FLEA INFESTATION

Cause.—In the United States there are four species of fleas which are of interest as parasites of dogs and cats.

These include two very similar species, called respectively the dog flea, *Ctenocephalus canis*, and the cat flea, *C. felis*, the other two being the common human flea, *Pulex irritans*, and the sticktight or chicken flea, *Echidnophaga gallinacea*.

The dog flea (fig. 12) appears to be the most common flea attacking dogs and people in the eastern portion of the United States. It moves about on the host animal between feeds, transfers readily from dog to dog and from dog to man, but is disposed to remain on some host animal rather than off. The eggs laid by the flea fall off the host animal and in the course of time hatch, giving rise to elongate larvae which feed on the animal and vegetable content of the trash present in the dog's bedding or in other places frequented by dogs. In time the larva forms a sort of cocoon, and after a period in the pupal stage the insect emerges as an adult flea. In the house the development from egg to adult commonly takes place in carpets and rugs, and in the trash in cellars and basements. The closely related cat flea has a similar habit and life history.

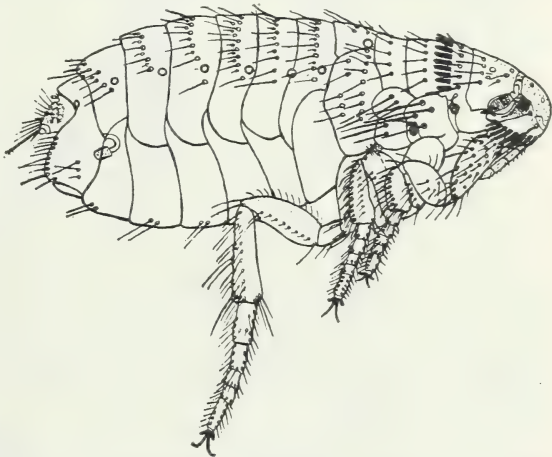


FIGURE 12.—The dog flea, *Ctenocephalus canis*. Female. Lateral view. Enlarged. From Martini, 1923.

The human flea (fig. 13) appears to be the most common flea attacking dogs and persons along the western coast of the United States

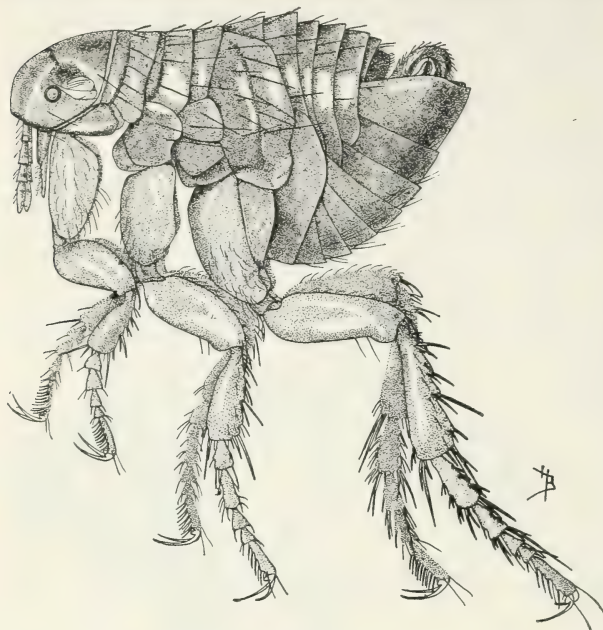


FIGURE 13.—The human flea, *Pulex irritans*. Male. Lateral view. Enlarged. From Bishopp, 1921.

and in parts of the South. It has substantially the same habits as have the dog and cat fleas, but spends more time off its host animal than do these fleas.

The sticktight flea (fig. 14) is most common in the Southern and Southwestern States, but may occur as far north as Kansas. It is normally a parasite of poultry and may occur on birds in sufficient numbers to cause death. It has little disposition to move about on its host,

but remains firmly attached to the skin most of the time. Dogs usually become infested with this flea by contact with infested fowls and premises.

Symptoms.—A number of species of fleas, including the dog fleas, are known to carry the organism of bubonic plague, a very serious disease which man shares with such rodents as rats. This plague occasionally occurs in the United States. The human flea is thought to convey infantile kala-azar at times. The dog flea, cat flea, and human flea act as intermediate hosts of the double-pored tapeworm, just as the biting louse has already been shown to act. In the case of fleas the larval fleas become infested with the larval tapeworms by eating tapeworm eggs present in contaminated trash, in bedding, and elsewhere. Fleas are, therefore, dangerous as carriers of disease and parasites.



FIGURE 14.—The chicken flea or sticktight flea, *Echidnophaga gallinacea*. Female. Lateral view. Enlarged. From Bishopp, 1921.

Aside from their role as carriers, fleas are not only a cause of discomfort, itching, and irritation to infested dogs and cats, but are especially annoying in that they readily leave their dog hosts to attack man. While a few flea bites cause but little annoyance to some persons, they cause great discomfort to susceptible individuals, and may produce lesions which are more or less serious and heal slowly. Numerous and repeated flea bites cause intense itching and lead to loss of sleep and of nervous energy, a thing which may be a serious matter in summer, when hot weather makes it difficult to sleep even under otherwise favorable conditions.

Treatment.—To be effective any treatment must simultaneously lead to the destruction of the fleas on the animal and of the eggs, larvae, and pupae in bedding and elsewhere. The infested dog may be dipped in a coal-tar creosote solution of suitable strength. If this is not feasible, pyrethrum powder or powdered naphthalene may be used in the manner described in connection with dog lice. Derris powder, as recommended for the destruction of dog and cat lice, is very effective against fleas on dogs and cats. At the same time the kennels and runs should be thoroughly cleaned up, all loose trash burned, and the floors and woodwork scrubbed with a strong, hot coal-tar creosote stock dip. F. C. Bishopp, of the Bureau of Entomology, states that complete control is usually obtained by means of one thorough spraying with a good grade of creosote oil containing between 10 and 16 percent of tar acids. Where sticktight fleas are present on the premises, the infested fowls should be treated by the application of carbolated petrolatum to the clusters of fleas, and the houses, roosts, and other equipment cleaned and disinfected. Where dwellings are flea infested, liberal and repeated application of pyrethrum powder or naphthalene flakes on the floors, rugs, and carpets will serve to control the trouble if the process is carried out thoroughly. In some cases it may be necessary to fumigate with hydrocyanic-acid gas, a proceeding which should be undertaken only by some competent and responsible person. In many places dogs and cats are primarily responsible for the presence of fleas in the house and they should either be kept free from fleas or kept out of the house.

INTERNAL PARASITES AND DISEASES DUE TO THEM

A large number of different kinds of worms have been found in dogs and cats in various parts of the world, but only a few of the more important need be discussed here. Some are important because they are seriously injurious to dogs or cats, and others because they may be transferred in some stage of their development to man and to livestock. Worms are most prevalent in pups and kittens, and are more injurious to them than to mature animals, many pups and kittens dying from worm infestations. This high infant mortality, so to speak, among dogs and cats as well as among human infants, indicates that there is a lack of proper care and of sanitation responsible for it. The remedy among dogs and cats, as among people, is proper care and sanitation. The mother should be free from internal and external parasites before being bred, should then be kept in an area free from parasitic infestation, and the pup or kitten should be born in clean surroundings and raised there until it can fend for itself and until it has acquired some age immunity or resistance to parasitic

infection and to the bad effects of infestation. For parasites, as for other evils, the ounce of prevention is worth the pound of cure. When a pup or kitten is infested with worms it is advisable to use medicinal treatment to remove them, and the more serious the infestation the more urgent the need of treatment, but the younger the animal and the more serious the need of treatment the more dangerous is the treatment. Cats are particularly susceptible to the unfavorable action of drugs and for this reason it is recommended that all treatments for worms in these animals be administered by a veterinarian.

In treating dogs or cats for worms, it should be kept in mind that worm remedies (anthelmintics) if potent are also dangerous, and should be prescribed and administered by a competent veterinarian whenever possible. Among the conditions which make drug adminis-

tration for worms especially dangerous are extreme youth, age, or weakness of the patient, or the presence of such debilitating diseases as mange or such febrile conditions as distemper. If treatment is imperative under these conditions, diminished doses should be given at 2-week intervals, removing part of the worms present each time and thus protecting the patient. Purgation is highly important in connection with anthelmintics. Adequate doses of a suitable purgative should be given, as a rule, with the anthelmintic, and if evacuation of the bowels does not occur in the course of 3 or 4 hours, another dose of purgative should be given. Enemas may also be given if it seems advisable.

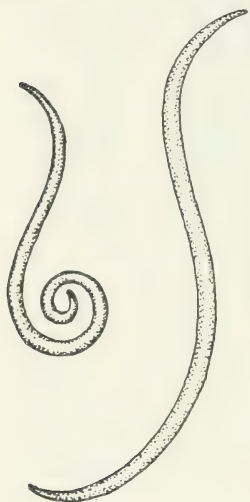


FIGURE 15.—The small white ascarid of dogs, *Toxascaris leonina*. Left, male; right, female. Actual size. From Neveu-Lemaire, 1912.

ROUNDWORM INFESTATION

Cause.—There are two species of roundworms (ascarids) which commonly infest dogs, and both of these occur in the United States. They look very much alike and for practical purposes need not be definitely identified. One of these, *Toxascaris leonina*, is a milky white worm (fig. 15) which may attain a thickness of about one-twelfth inch (2 millimeters); the male is 1.6 to 2.4 inches (5 to 6 centimeters) long, and the female is 2.4 to 5 inches (6 to 10 centimeters) or even 5.4 inches (13 centimeters) long. The internal genital tubes, which can be seen through the body wall, do not extend in the female into the anterior third of the body. This is the worm most likely to be present in mature dogs. The other ascarid, *Toxocara canis*, is pale butter yellow in color, of about the same thickness as the preceding, but usually longer; the male is 2 to 4 inches (5 to 10 centimeters) long, and the female is 2.4 to 7.2 inches (6 to 18 centimeters) or even 8.4 inches (21 centimeters) long. The internal genital tubes extend in the female into the anterior third, and commonly into the anterior ninth, of the body. This is the worm most likely to be present in pups.

Cats, especially kittens, are sometimes infested with roundworms. Two species may be encountered, one being *Toxascaris leonina* and

the other *Toxocara cati*. The latter species is the more common and is very similar in appearance to *T. canis*.

The female worms produce numerous eggs (fig. 16) which pass out in the feces and develop under favorable conditions of warmth and moisture, in the course of 2 or 3 days under very favorable conditions, to the stage where each egg contains an infective embryo worm. When such eggs are swallowed by dogs in contaminated food or water or in other ways, the eggs hatch and the young worms enter the walls of the digestive tract, get into blood vessels or lymph vessels, and finally many of them get to the lungs, usually by way of the blood stream through the liver and heart. In the lungs they leave the blood and enter the air passages, ascend these air passages to the mouth and are swallowed. On reaching the intestine they settle down and grow to mature worms, the females beginning egg production in the course of a few weeks. Prenatal infection of the pups in the uterus of the pregnant bitch has been shown to occur with the second of the ascarids referred to above.

Symptoms.—These ascarids are especially injurious to pups, and as many as 2,000 have been found in one animal. They cause derangements of the appetite and digestion, and heavily infested pups become unthrifty and emaciated and may die if the condition is not relieved. When present in large numbers the worms may form masses which produce a stoppage of the bowels, they may wander into the ducts of the liver, into the stomach, causing the animal to vomit the worms, or may crawl up the esophagus and enter the lungs or nostrils. The young worms leaving the blood and entering the air passages of the lungs may cause such serious injury to the lungs as to produce pneumonia and this may terminate in death.

The presence of these worms may be suspected when pups are unthrifty and have a history of passing worms or when they are known to have been associated with older dogs infested with worms. The symptoms of roundworm infestation in cats are about the same as those for roundworm infestation in dogs. Bloating and evidence of acute abdominal pain are the usual symptoms of roundworm infestation in kittens. Diagnosis is best made by a microscopic examination of the feces and the finding of the eggs (fig. 16). This examination can be made by any competent veterinarian.

Treatment.—The most effective drug for removing ascarids from dogs is oil of American wormseed (chenopodium). It may be given in hard or soft gelatin capsules at a dose rate of one-fourth fluid dram (1 cubic centimeter) for a dog weighing 22 pounds (10 kilograms). This should be immediately preceded or followed by 1

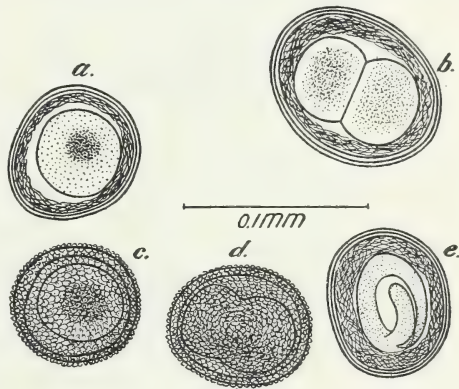


FIGURE 16.—Eggs of dog ascarids: a, b, e, *Toxascaris leonina*; c, d, *Toxocara canis*. Enlarged. From Wigdor, 1918.

fluid ounce of castor oil. The dog may vomit after treatment, but experiments on many dogs show that the treatment will remove all the ascarids present in practically all cases regardless of vomiting. If the bowels do not move in 4 or 5 hours it is advisable in the case of sick or weak dogs to give another ounce of castor oil. As already noted, it is dangerous to give chenopodium to dogs under certain circumstances, and the services of a veterinarian should be obtained if possible to prevent accidents. The feces passed for the 2 days after treatments for worms of any sort should be carefully collected and burned or buried deep, as they have an unusually high content of worm eggs.

Either carbon tetrachloride or tetrachlorethylene, given in the same dose and manner as stated for hookworms (p. 23), is also very effective in removing ascarids from dogs, being only a little less effective than chenopodium; either is safer than chenopodium. In cases of heavy ascarid infestation, particularly in puppies, it is advisable to follow either of the above-mentioned drugs in 5 hours by an adequate dose of castor oil to prevent clumping of the ascarids in the intestinal tract with possible obstruction; or a suitable dose of Epsom or Glauber's salt may be given immediately following the treatment.

Santonin is effective in removing ascarids from dogs when it is properly given. It is usually safe and is especially valuable in the case of animals in which the digestive tract is inflamed. It should be given in the morning, 3 hours before feeding, every day for 5 or 6 days in doses of one-fourth to 1 grain, according to the size of the animal, and accompanied by an equal quantity of calomel.

Oil of chenopodium is twice as toxic for cats as for dogs and should not be used for cats in a dose exceeding 0.05 cubic centimeter for each 2.2 pounds of body weight or 0.25 cubic centimeter for an 11-pound cat, immediately preceded or followed by a purgative dose of castor oil. Tetrachlorethylene administered in gelatin capsules in a dose of one-fourth fluid dram (1 cubic centimeter) for an 11-pound cat, followed in 5 hours by an adequate dose of castor oil, is a safe and effective treatment for the removal of ascarids from cats.

Preventive measures are along the line of sanitation and depend largely on the fact that the infective agents are the worm eggs which pass in the feces. The prompt and thorough removal of these feces from yards and kennels removes the source of infection. Dirt surfaces should be scraped and renewed from time to time, and wooden and concrete structures cleaned with boiling water, soap, and lye, or hot, strong coal-tar creosote solutions, dependence for results being placed primarily on the vigorous and thorough use of a brush. Especial attention should be paid to keeping pups or kittens in clean areas away from infected places and from older animals, and to keeping these older animals free from worms by treatment whenever necessary.

HOOKWORM INFESTATION (KENNEL ANEMIA)

Cause.—Dogs are frequently infected in this country with the common dog hookworm, *Ancylostoma caninum*. This worm (fig. 17) is comparatively small, the male from a little over one-third to one-half inch (9 to 12 millimeters) long, and the female from a little over one-third to almost 1 inch (9 to 21 millimeters) long, and thinner than an ordinary pin. The mouth is armed with six pointed teeth (fig. 18),

and the worm attaches with this armed mouth to the lining of the small intestine and sucks blood. Another dog hookworm, the narrow-headed hookworm, *Uncinaria stenocephala*, is not uncommon in dogs



FIGURE 17.—A portion of the small intestine of a dog; slit open to show 6 attached hookworms. Natural size. Adapted from Fiebiger, 1923.

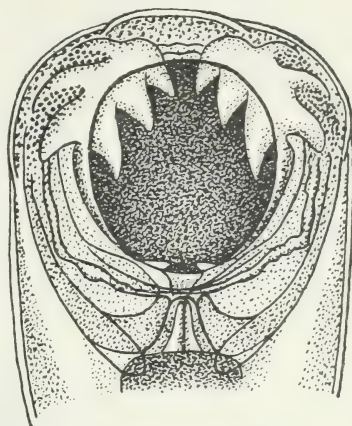


FIGURE 18.—The common dog hookworm, *Ancylostoma caninum*. Head. Dorsal view. Enlarged. From Riley and Fitch, 1912, after Looss.

in Europe and in foxes in the United States and Canada, but appears to be very rare in the dog in this country. This is a smaller worm, the male being one-fifth to one-third inch (5 to 8 millimeters) long,

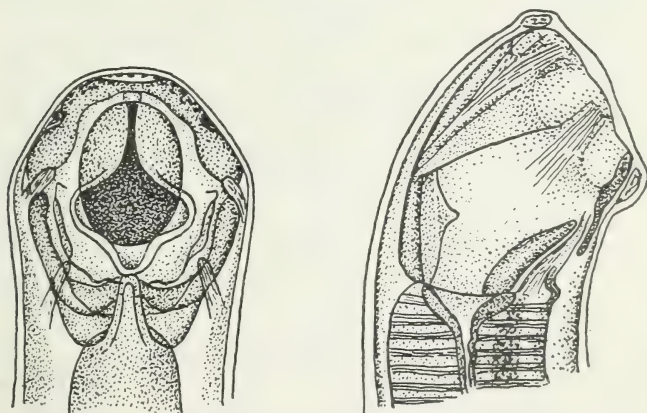


FIGURE 19.—The narrow-headed dog hookworm, *Uncinaria stenocephala*. Head. Left, dorsal view; right, lateral view. Enlarged. From Riley and Fitch, after Looss.

and the female one-third to almost one-half inch (8 to 11 millimeters) long. The mouth is armed with cutting plates (fig. 19), but is without the six teeth which are present in the common dog hookworm. It is, however, a blood sucker like the other.

A third species of hookworm, *Ancylostoma braziliense*, is sometimes found in dogs in the Southern States. This worm is about the size of *Uncinaria stenocephala*; the mouth is armed with 2 large and 2 small teeth. All three of these hookworms may occur in cats, the most common being *A. caninum*.

The female worms produce numerous eggs (fig. 20) which pass out in the feces and under favorable conditions may develop in the course of 36 hours to the stage where each egg contains an active embryo. In the course of from 3 to 6 days, as a rule, a first-stage larva hatches from the egg. In about 3 more days this larva molts its skin and forms a second-stage larva. In about 8 more days this larva molts to form a third-stage larva which retains the skin of the previous stage for a time at least. This is the infective larva, capable of infecting dogs when swallowed in contaminated food or water, or when put in contact with the feet or any part of the dog's skin. Whether the larvae enter by the mouth or through the skin, they go into the circulation and behave in much the same way that the ascarid larvae behave, ultimately getting to the lungs, entering the air passages, going up these to the mouth, being swallowed, and

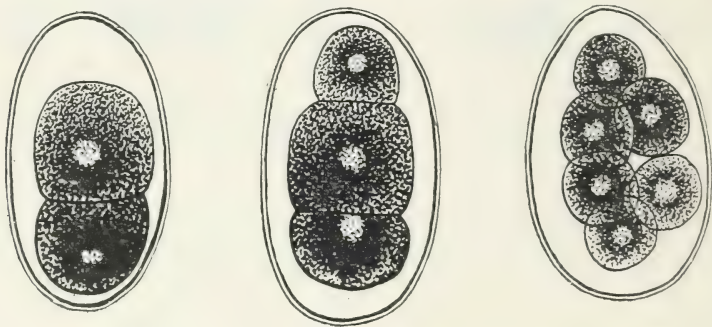


FIGURE 20.—Eggs of common dog hookworm. Enlarged. From Railliet, 1893.

finally reaching the small intestine, where they undergo two more molts and then become mature worms. Eggs from these worms usually appear in the feces in 4 or 5 weeks after infection takes place, but have been said to appear as early as 16 days after infection. In all probability prenatal infection of pups in the uterus of the mother occurs occasionally, and perhaps frequently.

Symptoms.—Owing to the fact that hookworms are bloodsuckers and that such worms not only remove blood from an animal but also appear to produce poisonous substances which exert an injurious effect on the blood, dogs heavily infested with hookworms usually show anemia (a condition in which the blood is thinner and paler than normal, which is shown by a pale color of the mucous membrane in the lining of the mouth and eyelids) and edema (a condition in which there is an accumulation of serum which seeps from the thinned blood into the tissues and accumulates in pendant portions of the body, as under the jaw). The disease is sometimes referred to as kennel anemia. In early stages of the disease there are digestive disturbances, and in later stages there is often diarrhea, sometimes with blood visible in the feces. Owing to the impoverished condition of the blood and to other disturbances due to the worms, the

infested dogs become weak and emaciated, the resistance to disease and to unfavorable conditions is diminished, and the vitality is reduced. In severe cases the following symptoms may be observed: A sunken eye, foul breath, unthrifty coat, reddening of the skin inside the thighs and elbows, pronounced dullness or depression, and a slow healing of operative wounds or accidental injuries, with a tendency to ulcer formation in such cases. The larval worms going through the lungs have been reported as the cause of a fatal pneumonia in pups. Pups are highly susceptible to infection with hookworms and to the bad effects of such infestations and many of them die from hookworm disease, especially in the South.

When the symptoms noted above are present, hookworms may be suspected as the cause, but it is inadvisable to allow dogs to go to the stage where they show clinical evidence of hookworm disease, as such dogs have a diminished resistance to the drugs used in removing the hookworms. In regions where hookworms are prevalent, especially in the South but also in many other parts of this country, the feces of dogs, and especially of pups, should be examined occasionally for worm eggs, and, if they are present, suitable treatment undertaken at once without waiting for ill effects to become evident.

Hookworm infestation in cats is usually light and is likely to be overlooked. Heavy infestations, however, would give rise to symptoms similar to those described previously for dogs.

The larvae of *Ancylostoma braziliense* may attack man and give rise to a progressive type of skin eruption known as "creeping eruption," which is sometimes very difficult to cure.

Treatment.—Carbon tetrachloride in a dose of 0.3 cubic centimeter per kilogram (2.2 pounds) of body weight, or 3 cubic centimeters for a 22-pound dog, is an effective drug for the removal of hookworms. Carbon tetrachloride should not be given to very young dogs or to those suffering from calcium deficiencies, such as rickets, etc. Tetrachlorethylene is an effective drug for the removal of hookworms from dogs. It should be given in a dose of 0.2 cubic centimeter per kilogram of body weight or 2 cubic centimeters for a 22-pound dog. Tetrachlorethylene is a much safer drug than is carbon tetrachloride and should be used in preference to the latter, particularly in the treatment of animals in poor physical condition, in puppies and young dogs, and in those suffering from calcium deficiencies.

Either of these drugs may be given in hard or soft gelatin capsules. Care should be taken to avoid breaking such capsules in the mouth as inhalation of the above-mentioned drugs may lead to serious reactions. Animals should be fasted for 12 hours prior to treatment. The common procedure is to give the usual meal at night, and to administer the treatment in the morning before feeding. Animals may be fed 3 hours after treatment but in case a purgative such as castor oil is administered some time after the anthelmintic, food should be withheld until after its administration. In the ordinary case of hookworm infestation, a purgative is not necessary in connection with the above-mentioned drugs, but in cases of concomitant ascarid infestations, particularly in puppies and young dogs, it is advisable to administer Epsom salt or Glauber's salt immediately following the worm medicine or to give an adequate dose of castor oil 5 hours after the administration of the worm medicine. Some veterinarians prefer milk of

magnesia as a purgative for puppies and young dogs; this may be given immediately following carbon tetrachloride or tetrachlorethylene but an amount sufficient to produce an adequate bowel movement should be administered. Fats, oils, and cream should be excluded from the diet for several days prior to the administration of either carbon tetrachloride or tetrachlorethylene. This applies also in the case of cats.

Tetrachlorethylene is the drug of choice for the removal of hookworms from cats, being much safer for use in cats than is carbon tetrachloride. The dose rate and the manner of administration are the same as for dogs. In cases of concomitant ascarid infestations in cats, a purgative should be given as outlined above.

Ordinarily treatments for worms should not be given to pups until they are weaned, but usually pups 2 weeks old or older may be given tetrachlorethylene with safety. Animals with severe inflammation of the digestive tract appear to be bad risks for this treatment as for most anthelmintic treatments. In connection with the treatment, the same preventive measures given for ascarids should be employed.

WHIPWORM INFESTATION

Cause.—The whipworm, *Trichuris vulpis* (synonym, *T. depressuscula*), is so named because of its resemblance to a tiny whip (fig. 21), the short, thick posterior portion of the body forming the handle and the slender, anterior portion, which is about three times as long, forming the lash. It is from 1.8 to 3 inches (4.5 to 7.4 centimeters) long. The eggs (fig. 22) produced by the female worms are lemon-shaped, with a knob at each pole. These worms are very common in dogs in the United States but are not known to occur in cats.

The worm eggs pass in the feces and an embryo develops in each egg. As a rule this development is slow, usually requiring several

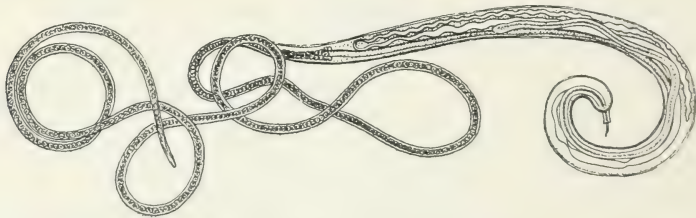


FIGURE 21.—The dog whipworm, *Trichuris vulpis*. Male. Enlarged. From Fiebiger, 1912.

months. When eggs containing these infective embryo worms are swallowed by a suitable host the eggs hatch and the young worms develop for a short time in the small intestine and subsequently in the cecum (the blind gut at the union of the small and large intestines). Here they apparently enter the mucosa by means of a piercing lancet in the mouth of the young worm. As the worm develops, the anterior portion of the body remains sewed into the mucosa, while the posterior portion hangs free in the lumen of the cecum. The worms apparently become mature in about 3 months. In heavy infestations these worms may occur in the colon and rectum as well as in the cecum.

Symptoms.—These worms not infrequently give rise to a low-grade inflammation at the point where they attach, and as they are

most commonly present at the tip of the cecum this is the place where a reddened area is most often seen. The worm's habit of sewing into the mucosa opens small wounds which probably afford entrance for injurious bacteria. A closely related species of worm in man appears to be responsible for symptoms of distress resembling a low-grade appendicitis. The exact symptoms produced by these worms in dogs are as yet matters which require more careful investigation than they have received. In many cases the worms appear to do little harm and to cause no visible symptoms.

Treatment.—Whipworms are not very resistant to the drugs which are injurious to parasitic worms in general, but at the same time the removal of these worms is somewhat difficult. Apparently the reason is that it is difficult to get the drugs in contact with the worms. In their passage through the stomach and small intestines drugs are greatly diluted with the contents of the digestive tract and are also absorbed to a greater or less extent. Of the amount of drug which reaches the ileocolic valve, at the union of the small and large intestines, only a little and perhaps none will enter the cecum or get to its tip where the worms are usually situated. Consequently a single dose of a drug is less likely to reach and kill the worms than it is to miss them. When a number of repeated doses are given, the likelihood of the drug's reaching the worm is greatly increased. At present the most satisfactory and feasible treatment consists in the daily administration of equal amounts of santonin and calomel in the morning, in doses of one-fourth to 1 grain each, according to the size of the dog, the treatment being kept up for a week, suspended for a week, and then repeated for a week. In place of using this routine treatment over a period involving 3 weeks, the treatment may be kept up as long as the whipworm eggs appear in the feces on microscopic examination, suspended whenever they disappear, and stopped if repeated examinations of the feces show that eggs are no longer present.



FIGURE 22.—Egg of dog whipworm. Enlarged. From Riley and Fitch, 1921.

HEART-WORM INFESTATION

Cause.—The heart worm, *Dirofilaria immitis*, of dogs and, occasionally, of cats occurs in the right ventricle of the heart and in the pulmonary artery (fig. 23). This worm is long and slender, the male about 5 to 7 inches (12 to 18 centimeters) long, and the female 10 to 14 inches (25 to 35 centimeters) long. The eggs hatch in the uterus of the female worm and the larvae are deposited directly into the blood stream. The heart worm is commonly encountered in dogs in the South but apparently this parasite is extending its range to the North. It is found not only in dogs which have been taken South for hunting or other purposes, but also in dogs born and raised in the North that have never been in the South.

The life cycle of the worm is complex. The larvae which the female worm discharges into the blood are abundant in the blood vessels of the skin, especially at night. Mosquitoes feeding on infested dogs take these larvae into the digestive tract with the blood, and the larvae pass through the walls of the mosquito's stomach and reach the malpighian tubules where they undergo considerable development. Later, the young worms pass to the mouth parts of the mosquito,

escape by breaking through the walls of the labium while the insect is feeding, and enter the blood vessels of the skin through the wounds produced by the bites of the mosquito. The young worms eventually reach the heart where they become sexually mature in 8 or 9 months. Short-haired dogs are more susceptible to heart worms than long-haired dogs, probably because they have less protection against mosquito bites.

Symptoms.—The presence of these worms in the heart may give rise to a variety of symptoms. In hunting dogs the first symptom usually noted is that the animal tires easily; the dog may gasp, breathe heavily and collapse. In cases of long-standing abdominal dropsy, the edematous swellings of the lower part of the chest and legs are common symptoms. A cough may be present, and nervous symptoms, such as photophobia or fear of light, convulsions, and symptoms resembling those of rabies or hydrophobia have been reported. Death may result from asphyxia, embolism, and dilation of the heart.

Diagnosis is made by microscopic examination of the blood for the presence of larvae; this can be done by any competent veterinarian.

Treatment.—A drug consisting of sodium-antimony-III-bis-pyrocatechin-disulphonate of sodium has been found of value in the treatment of dogs infested with the heart worm. Intramuscular injections are made daily for 6 days each week, treatment being omitted every seventh day. The initial daily dose, administered over the first 6 days, varies from 0.5 to 1.0 cubic centimeter, depending on the weight and condition of the animal. For each succeeding 6-day period, the daily dose is increased by 0.5 to 1.0 cubic centimeter, the

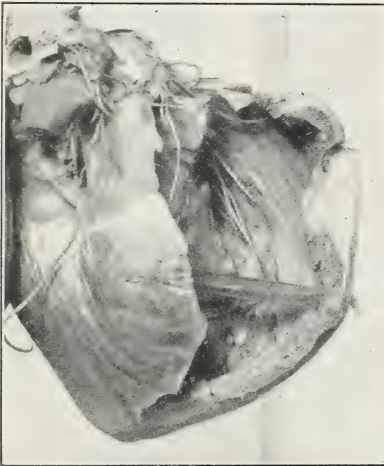


FIGURE 23.—Heart of dog, showing heart worms, *Dirofilaria immitis*.

maximum daily dose being 3.0 cubic centimeters. In tests in the Bureau of Animal Industry, the total amount of the drug required to effect a disappearance of the microfilariae from the peripheral circulation has varied from 21 to 33 cubic centimeters, and the course of treatment has lasted from 20 to 25 days. Apparently a maximum concentration of antimony in the system is necessary to effect permanent sterilization of the blood stream, and, in general, best results are secured when treatment is pushed to the limit of tolerance in order to attain this concentration as rapidly as possible. However, not all dogs are capable of tolerating a continuous course of injections, and in some cases it may be necessary to suspend treatment for a period of several days if unfavorable reactions occur.

Dogs which are in good condition and which do not show marked symptoms of heart involvement generally tolerate the course of injections without showing marked unfavorable reactions. Other animals show mild to severe systemic reactions which consist in rise in temperature and increase in the respiration and pulse rates. In case

these symptoms appear, it is advisable to suspend treatment until the temperature and pulse rate return to normal.

Experiments indicate that some or all the adult worms are killed by the drug. Treated animals usually show improvement in physical condition, in heart action, and in working capacity.

The drug may be used intravenously also, and the period of treatment can be shortened by the use of this method. For a 40-pound dog, the initial dose is 1.0 cubic centimeter; a dose of 2.0 cubic centimeters is given on the third day; on the fifth, seventh, and eighth days, a dose of 2.5 cubic centimeters; and on the ninth, tenth, and twelfth days, a dose of 5 cubic centimeters is administered.

No standard dose rate for this drug can be prescribed, and emphasis is placed on the fact that the dose must be judged on the basis of degree of infestation and the physical condition, as well as the weight, of the animal. In view of this fact, treatment should be administered only by a veterinarian. Until experience is gained through the use of the drug, a low dose rate should be used for the first 2 or 3 injections in order to establish tolerance of the animal for the drug. In case of severe reactions following the use of the drug, the administration of a suitable dose of a 10-percent solution of calcium gluconate has been found of value.

Prevention consists in keeping dogs from being bitten by mosquitoes. Dogs should be kept away from places frequented by mosquitoes, especially after sundown and in the early morning. Keeping dogs in enclosures screened to keep out mosquitoes is sound practice, and in the Fiji Islands mosquito-proof kennels with self-closing doors have been used.

TAPEWORM INFESTATION

Cause.—Tapeworms are elongated, flat worms made up of few to numerous segments and with a head which is usually provided with 4 suckers and 2 or more hook circlets. The head is located at the small end of the worm. Dogs are infested with a number of kinds of tapeworms, ranging in size from the small hydatid tapeworm, *Echinococcus granulosus* (synonym, *Taenia echinococcus*), which is less than two fifths of an inch (1 centimeter) long, to the marginate tapeworm, *T. hydatigena* (synonym, *T. marginata*), which is from 2.5 to over 16 feet (75 centimeters to 5 meters) long, or to the broad fish tapeworm, *Diphyllobothrium latum* (synonym, *Dibothriocephalus latus*), which may attain a length of almost 30 feet (9 meters). All the dog tapeworms live in the small intestine of the dog. All of them produce eggs which pass out in the feces and which on being swallowed by a suitable host animal will develop to a larval tapeworm, taking the form of a bladderworm of some sort. The host of this bladderworm will be in some cases a domesticated animal, such as the sheep, cow, or pig; in some cases a wild animal, such as the hare or rabbit; in some cases a fish; and in other cases an insect, such as the dog louse or flea. In any case the bladderworm will not occur in the lumen of the digestive tract, but will occur in the tissues, such as the lungs, liver, muscles, mesenteries, brain, or intermuscular or subcutaneous connective tissue, or in the body cavity. In the larger animals, such as sheep, cattle, and swine, the bladderworms may be very large, as in the case of the hydatid, which may attain the size of a child's head and which is often the size of an orange; in insects, such as the flea or louse, the bladderworm is very tiny, as it must be in a host of this size.

Probably the most common of the tapeworms in the dog is the common double-pored dog tapeworm, *Dipylidium caninum*. This

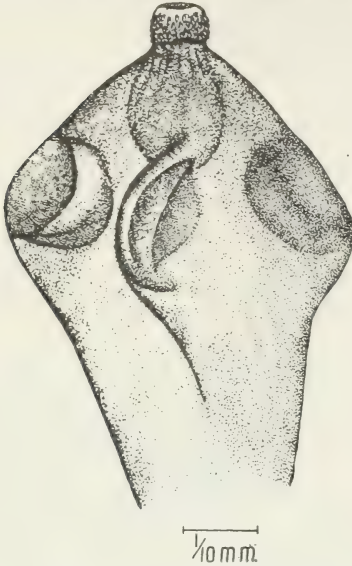


FIGURE 24.—The six-crowned double-pored tapeworm, *Dipylidium sexcoronatum*. Head. Enlarged. From Hall, 1919.

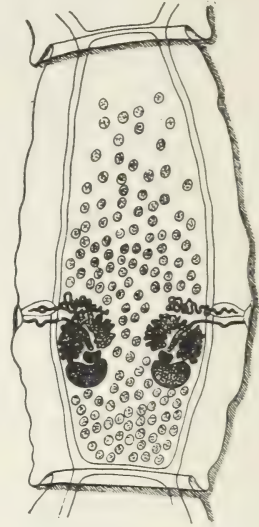


FIGURE 25.—Mature segment of six-crowned double-pored tapeworm, *Dipylidium sexcoronatum*. Enlarged. From Hall, 1919, after von Rätz, 1900.

tapeworm and a closely related species, the six-crowned double-pored tapeworm, *D. sexcoronatum*, have more than two circlets of hooks on the head (fig. 24), and have a genital pore on each side of each segment (fig. 25); the thin-shelled eggs occur in egg capsules (fig. 26) and are often found in these capsules in the feces. The segments may be



FIGURE 26.—The common double-pored tapeworm, *Dipylidium caninum*. Egg capsule. Enlarged. From Stiles, 1903.

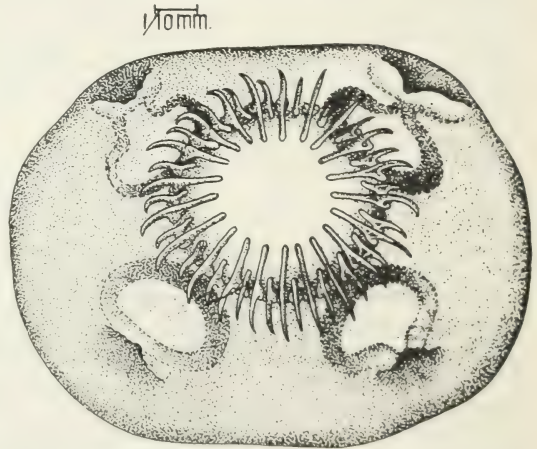


FIGURE 27.—The serrate dog tapeworm, *Taenia pisiformis*. Head, viewed from the front. Enlarged. From Hall, 1919.

white or pink, and the terminal segments break off from time to time and either escape in the feces or creep out of the anus; such escaping

segments are often seen and referred to as rectal worms or pinworms. The common double-pored tapeworm has a larval stage in fleas and the biting lice of dogs. The fleas become infected while they are flea larvae feeding on the organic matter in trash, the larval fleas swallowing the tapeworm eggs in this trash. Biting lice swallow the eggs while feeding on the contaminated skin of the dog. In these insects the tapeworm eggs hatch and the escaping embryo develops to a larval tapeworm in the body of the insect. When dogs, annoyed by the itching and irritation due to these insects, hunt them out and swallow them, the tapeworm larvae become adult tapeworms in the intestine of the dog. This tapeworm sometimes occurs in man, especially in children, as a result of the accidental swallowing of infested fleas or lice by persons.

A larger group of tapeworms is made up of forms which have only two circlets of hooks (fig. 27) and have a genital pore on only one side of each segment (fig. 28). The thick-shelled eggs do not occur in egg capsules but in a uterus from which some eggs escape into the intestinal contents and feces. The eggs (fig. 29) occur as isolated specimens

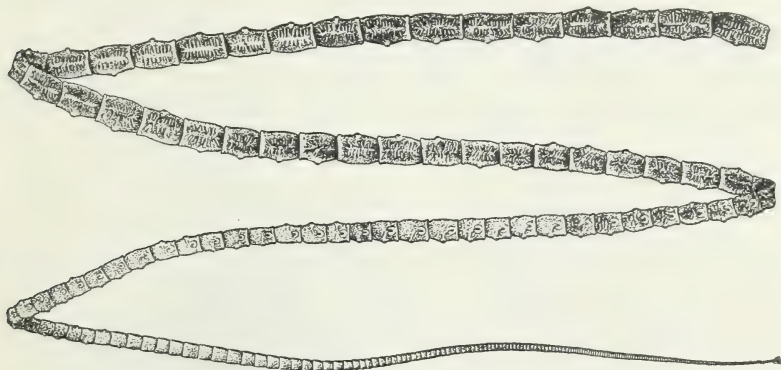


FIGURE 28.—The gid tapeworm, *Multiceps multiceps*. Entire worm. Actual size. From Hall, 1910.

in the feces. The segments, usually containing only a part of the original egg content, escape in the feces and in time break up, releasing the remaining eggs, which are washed about on the ground and on vegetation by the rain. When such eggs are swallowed by suitable hosts, such as sheep, cattle, swine, hares, rabbits, etc., the hosts varying with different species of tapeworms, the eggs hatch and each releases an embryo which penetrates the walls of the digestive tract and develops in some tissue (liver, lungs, muscles, brain, intermuscular or subcutaneous connective tissue, etc.) to form a larval tapeworm or bladderworm (fig. 30). When these bladderworms are eaten by dogs, the tapeworm head in the bladderworm resists digestion and becomes the head of a tapeworm in the intestine of the dog.

Other dog tapeworms include such forms as the broad fish tapeworm, *Dipyllobothrium latum*, which has 2 slitlike suckers in place of the 4 rounded suckers of the preceding forms, and which has its intermediate stages in fish. Dogs become infected by eating infested fish. The broad fish tapeworm also occurs in man.

Cats may harbor the double-pored dog tapeworms, *Dipylidium caninum* and *D. sercoronatum*, the broad fish tapeworm, *Dipyllo-*

bothrium latum, and the cat tapeworm, *Taenia taeniaeformis* (synonym, *T. crassicollis*), the latter species being the most important. *Taenia taeniaeformis* is from 6 inches to 2 feet (15 to 60 centimeters) long, the head is armed with a double circle of hooks, and the suckers, four in number, are prominent, pointing forward and outward; there is no neck, segmentation beginning immediately back of the head, and the first segments being as broad as the head or broader. The bladder-worm stage of this tapeworm occurs in the livers of rats, mice, muskrats, and other rodents. Cats become infested by eating the infested livers of these animals.

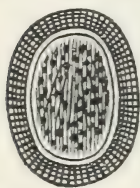


FIGURE 29.—Egg of the serrate dog tapeworm, *Taenia pisiformis*. Enlarged. From Railliet, 1893.

Symptoms.—In general, tapeworms in the dog may cause disturbances in appetite and digestion, a disposition to vomit, general restlessness, and sometimes cramps. In heavy infestations they may cause an inflammation of the digestive tract and occasionally cause occlusion, or stoppage, of the intestine by filling and blocking the intestinal lumen. In addition, tapeworms in heavy or even light infestation may cause more or less well-marked nervous disturbances, in some cases simulating rabies. The passage of a segment or a string of segments through the anus often causes itching or irritation, manifested by the dog's sitting down and dragging itself forward on its haunches. This symptom is sometimes said to be due to pinworms in the dog, but dogs do not have pinworms. The common double-pored tapeworm is especially likely to cause this symptom, and segments of this worm are sometimes referred to as pinworms or rectal worms.

Cats infested with *Taenia taeniaeformis* may show loss of appetite, transient diarrhea followed by constipation, salivation and, in some cases, persistent vomiting. In kittens the abdomen may be distended, the animals exhibiting evidences of acute abdominal pain. Nervous symptoms, such as epileptiform convulsions, have been reported as symptoms of tapeworm infestation of cats.

Treatment.—One of the most effective treatments for the removal of tapeworms from dogs consists in the administration of arecoline hydrobromide in doses of one-eighth grain to small dogs, one-fourth grain to dogs of medium size, and one-half grain to large dogs. The treatment is given in the morning after food has been withheld overnight, and no food is given for 3 hours after dosing. No purgative is given with this drug, as the drug usually is itself a very fast and effective purgative. The efficacy of arecoline hydrobromide is said to



FIGURE 30.—Sheep muscle showing two bladderworms, *Cysticercus ovis*. Actual size. From Hall, 1921, after Ransom, 1913.

be somewhat enhanced by the use of preliminary high colonic irrigations. The drug is quite safe in the majority of cases, but in many cases the animal will appear depressed and subdued for some time after treatment. Very weak or sick animals must be given diminished doses or given some other and safer treatment if treated at all. In any case, and especially in the case of such sick and weak animals, it is advisable to call in a veterinarian. Other drugs which may be used are those such as oleoresin of male fern, kamala, and freshly ground areca nut.

Arecoline hydrobromide may be used for the removal of tapeworms from cats, but the drug is more poisonous for cats than it is for dogs. The dose of the drug is from one twenty-fifth to one-sixteenth grain for adult cats of average weight; the latter dose should not be exceeded. Kamala in a dose of 1 gram in hard gelatin capsules for an average-sized cat is another treatment which is quite effective for the removal of some species of tapeworms from cats. As cats are particularly susceptible to poisoning with tapeworm remedies, it is preferable that such remedies be administered by a veterinarian who is best qualified to judge the proper dose of any such drug.

FLUKE INFESTATION

There have been a number of species of flukes reported from dogs and cats in various parts of the world. One species, *Trogloremma salmincola*, is of special importance, since it is responsible for a fatal disease of dogs known as salmon poisoning.

Cause.—The salmon-poisoning fluke is very small, about one fiftieth to one twenty fifth of an inch (0.5 to 1 millimeter) long, and occurs in the small intestine of dogs. Cats may become infested, but apparently this fluke causes little or no injury to this animal. The distribution of this fluke in the United States is limited to Oregon, Washington, and the northern part of California.

The life history of the salmon-poisoning fluke, like that of other flukes, is complex. The egg of the fluke passes out in the feces and after a period of incubation in water releases a free-swimming larva or miracidium. This larva penetrates into water snails, *Goniobasis plicifera* var. *silicula*, and in the course of time gives rise to other larvae known as cercariae. These cercariae escape from the snail host and penetrate into, and become encysted in, the kidneys and flesh of salmonoid fishes. Dogs and other susceptible animals become infested with the parasite by eating such infested fish.

Symptoms.—The symptoms of salmon poisoning, which develop after the ingestion of infested fish, resemble those of distemper. Recent work by Oregon investigators indicates that the disease is due to a virus, the fluke acting as a carrier of the virus or as an inoculating agent. The disease manifests itself by a sudden rise in temperature about 6 to 8 days after the dog has eaten the infested fish; this rise in temperature is followed by a loss of appetite and marked depression. After the second or third day the temperature drops gradually, and this is followed by a discharge of pus from the eyes and swelling of the eyelids and face. The animal may vomit persistently. On the sixth or seventh day diarrhea sets in, the feces being blood tinged at first and later consisting of almost pure blood. There is a noticeable loss of weight, the temperature drops to subnormal, and usually the animal dies. Recovery is rare, but dogs recovering are immune to subsequent infection.

Treatment.—There is no satisfactory treatment for salmon poisoning; all drugs tried for the removal of the flukes have proved to be ineffective. It is reported that the disease may be prevented by the use of apomorphine within a few hours after dogs have eaten parasitized fish. The best prevention, of course, is to keep dogs from eating raw salmon taken in the area in which salmon poisoning occurs.

TONGUEWORM INFESTATION

Cause.—The tongueworm, *Linguatula serrata* (synonym, *L. rhinaria*), is not a true worm, but is a degenerate relative of the spiders, ticks, etc. It lives as an adult in the nostrils of the dog and

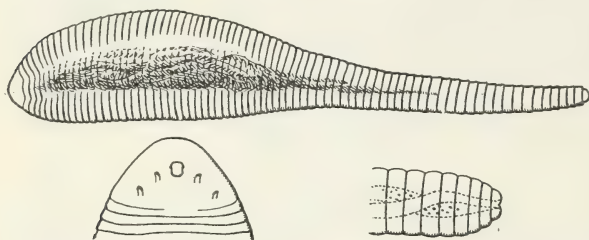


FIGURE 31.—The tongueworm, *Linguatula serrata*. Upper figure, entire animal. Lower left-hand figure, head. Lower right-hand figure, female tail, showing uterovagina (dotted) and intestine. Enlarged. From Sambon, 1922.

some other animals, and in this stage it is a wormlike animal with external ringlike segmentation (fig. 31). This parasite does not infest cats. The male is about four-fifths inch (18 to 20 millimeters) long, and the female is about 3 to 4 inches (8 to 10 centimeters)

long. The eggs (fig. 32) from the female worms in the nostrils of the dog pass out in mucus when the dog sneezes or are swallowed and pass out in the feces. When these eggs are swallowed by suitable host animals in eating contaminated vegetation, as by herbivores in grazing, the eggs hatch and the larvae make their way, as a rule, to the liver, lungs, and lymph glands and there develop to the infective stage. In the United States these larval tongueworms are fairly common in cattle in the South; in Europe sheep are the most common intermediate hosts. In view of the fact that the larvae may also occur in man, and that the adult is reported from man in one case, this parasite must be looked on as dangerous. Up to the present time it has been found in the dog only in Georgia, but it undoubtedly has a much wider distribution in this country, as the presence of the larvae in cattle shows, and failure to find it is largely due to failure to look for it.

Symptoms.—Dogs infested with tongueworms may show no symptoms or may have sudden attacks of sneezing, coming on when the dogs are active for any reason. There is often loud snoring, sometimes with almost complete stoppage of breathing. The animal may rub its nose with its paws as if to remove some obstacle. It is interesting to note that tongueworms have been found in dogs affected with what have been called "running fits" or "fright disease," a condition not yet very well understood. The same condition has been noted in dogs heavily infested with hookworms, and relief reported after successful treatment for hookworms. What relation these parasites or others might have to "running fits" is not known.



FIGURE 32.—Egg of tongueworm. Enlarged. From Koch, 1906.

Treatment.—No satisfactory treatment appears to have been established. Unless the parasites could be removed by the injection of some suitable substance into the nostrils, treatment would appear to be surgical. In default of successful treatment, dogs known to be infested with tongueworms should be destroyed on the ground that they are carriers of parasites which are dangerous to man and injurious to livestock.

COCCIDIOSIS

Cause.—Coccidiosis in the dog is due to the presence and effects of very small protozoan parasites. There are four species of these parasites reported from dogs. Some of them occur in the epithelium of the intestine and some of them under the epithelium in the submucous connective tissue. The parasites undergo certain developments in these tissues and multiply here. Ultimately they develop resistant forms called oocysts (fig. 33) which pass out in the feces and serve to infect other dogs. Cats are occasionally infected with coccidia but such infections are likely to be overlooked.

Symptoms.—In light infestations coccidia may cause no perceptible symptoms in dogs or cats, but in heavy infestations diarrhea appears at the time when the oocysts are passing in the feces and it may be accompanied by the passage of blood and gas. There may be a slight rise in temperature during this time. Under unfavorable conditions, as in heavy infestations in very weak or young dogs or those with secondary infections, the animals may die. The diagnosis of coccidiosis depends on the finding of oocysts in the feces.

Treatment.—No effective treatment for coccidiosis in dogs or cats is known. However, the disease appears to be self-limited, all of the organisms present developing in the course of time to the oocyst stage and passing out. From observations of the senior author this will probably occur, as a rule, within 2 weeks. There is some evidence indicating that an attack of coccidiosis confers some subsequent immunity. The indicated treatment, therefore, is along the lines of good care and nursing, the animal being fed nourishing food in quantities suited to its condition and protected against unfavorable conditions until the infection terminates. Such symptoms as diarrhea may be controlled by appropriate treatment if necessary. The premises occupied by infected animals must be regarded as infected, and thoroughly cleaned; the use of strong, hot coal-tar creosote dips appears to be of value. Heat and drying are destructive to oocysts. As indicated in the introductory paragraphs, preventive measures for this disease and other parasitic diseases are along the line of sanitation, and sanitary preventive measures are primarily the business of the dog or cat owner. In coccidiosis, as in the other diseases, diagnosis and treatment are primarily the affair of the veterinarian and the employment of a competent veterinarian is always advisable when diseases are actually present.

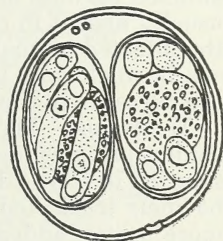


FIGURE 33.—A dog coccidian, *Isospora rivolta*. Mature oocyst. Enlarged. From Wenyon, 1923.

CANINE PIROPLASMOSIS

Cause.—Piroplasmosis in the dog is due to the presence in the red blood cells of a small protozoan parasite related to the organism causing tick fever of cattle. This parasite is transmitted from infected to healthy dogs through the bites of ticks. Several ticks have been incriminated as vectors of canine piroplasmosis in various parts of the world and among them is the brown dog tick, *Rhipicephalus sanguineus*. It is probable that *R. sanguineus* is the important vector of the disease in the United States, since this tick is common in some parts of this country. (See p. 12.) The extent of canine piroplasmosis in dogs in this country is not known, but one case in Florida has recently come to the attention of the writers.² Cats are not known to be susceptible.

Symptoms.—Canine piroplasmosis may be either acute or chronic. In the acute form of the disease the infected animal may show increase in temperature, reddening of the mucous membranes, increased pulse and respiration, loss of appetite, and increased thirst. Jaundice is present in about 50 percent of the cases. Acute cases frequently terminate in death.

In chronic cases fever may be present during the first days of the infection, and in rare cases there may be an intermittent fever. The animals become listless and the mucous membrane pale; jaundice is usually absent in chronic cases. There is a diminished appetite, and the infected animals become greatly emaciated. A positive diagnosis can be made only by microscopic examination of the blood and finding the parasites in the red corpuscles.

Treatment.—Trypan blue is said to be a specific in some forms of canine piroplasmosis. The drug is used in the form of a 2-percent solution in sterile distilled water. It is recommended that the powder be finely triturated with a small quantity of cold water in a mortar and more water added gradually until the dye enters completely into solution, which is then made up to the desired percentage. The solution should be filtered through filter paper and the filtrate autoclaved at a temperature of 120° C. for 20 minutes. When cool, the solution is transferred to sterile bottles which should be carefully sealed. The dose of the solution that has been suggested for a dog of average weight is 5 to 6 cubic centimeters injected intravenously. One dose of trypan blue is usually sufficient to effect a cure in infections with *Babesia canis*, one of the species causing canine piroplasmosis.

Tryparsamide has been reported also as being effective in the treatment of canine piroplasmosis. The dose of the drug for a 25-pound dog is given as 0.85 gram dissolved in 5 cubic centimeters of sterile distilled water, administered intravenously. Best results are obtained following the use of 5 injections with an interval of 5 days between each injection. Other arsenical preparations also have been recommended in the treatment of canine piroplasmosis.

² This report is based on a case diagnosed by Dr. Paul Eaton of the Florida Department of Health, the diagnosis being confirmed by Dr. G. Dikmans, of the Federal Bureau of Animal Industry.

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